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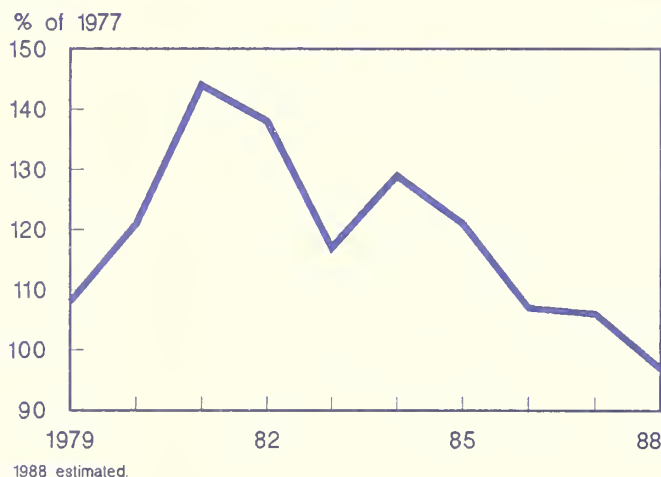
WAS-52  
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# World Agriculture

## Situation and Outlook Report

Severe summer drought  
cuts U.S. food grain  
production, see page 9

U.S. Food Grain Production



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## SUMMARY

*The global economic outlook* has improved over the 10 months since the worldwide decline in equity prices. Foreign economic growth is forecast at 3.1 percent in 1988 and 2.9 percent in 1989. The brighter outlook reflects stronger-than-expected growth in some industrialized countries, and prospects for expanded world trade. It now appears that overseas growth, rather than being a neutral factor, will bolster U.S. exports.

Despite heightened economic activity, the expected rate of inflation in Asia is only marginally above previous estimates. On the other hand, the pace of inflation has quickened in some countries, particularly in Latin America.

*Foreign industrial-country growth* is placed at about 3.2 percent in 1988 and 2.6 percent in 1989. Japan's economic growth is now expected to reach 5.0 percent in 1988 and 3.9 percent in 1989. Fueled by consumer spending and a major expansion in government public works spending, Japan has managed to achieve more balance between export and domestic growth.

*Forecast economic growth* in the United States in 1988 has been raised to 4 percent, partially because of a surge in exports. Recently, import growth has slowed somewhat, further reducing the U.S. trade deficit. While the United States has lowered its budget deficit, it still remains large. The U.S. economic growth rate in 1989 is expected to slow.

Europe also shows an improved forecast for 1988, with expectations for 2.6-percent growth (up 0.6 percent). But 1989 expectations remain at 2.2 percent. Expectations for 1989 are guided by the belief that Germany will narrow its fiscal deficit,

while Italy and the United Kingdom, faced with balance-of-payments problems, will slow their growth. Comprising about one-quarter of the EC economy, West Germany is expected to grow only 1.4 percent in 1989.

The forecast for *less-developed country growth* is virtually unchanged at 2.6 percent in 1988 and 3.5 percent in 1989. However, significant changes have been made for countries within the category. In particular, there is a marked deterioration of prospects in Latin America, where growth is now seen as essentially stagnant at 0.1 percent for 1988, but rebounding to 2.4 percent in 1989. The downward revision for 1988 was generated by declining prospects in Mexico and Brazil because of persistent inflation and debt problems.

In contrast, the forecast of *Asian economic growth* in 1988 has been revised upward by almost 2.0 percentage points to 7.1 percent, but is expected to revert to a more usual 5.7 percent in 1989. Taiwan, South Korea, Singapore, and Hong Kong account for much of the improvement, with better export performance than other Asian countries. In addition, several other countries in the region (e.g. Thailand, the Philippines, Malaysia, and Indonesia) are showing better export prospects as commodity prices strengthen and manufactured exports rise.

*Fiscal 1988 U.S. agricultural exports* are expected to finish the year at \$34 billion and 146 million tons, surpassing fiscal 1987's exports by more than \$6 billion and 16 million tons. Rising exports and steady imports have produced a growing positive trade balance. With the value of agricultural imports holding steady at \$20.5 billion, the U.S. agricultural trade surplus should climb more than \$6 billion, one of its largest year-to-year gains.

## THE WORLD ECONOMY AND EXCHANGE RATES

The global economic outlook has improved over the 10 months since the worldwide decline in equity prices. Foreign economic growth is forecast at 3.1 percent in 1988 and 2.9 percent in 1989. The improved outlook reflects stronger-than-expected growth in some industrialized countries, and prospects for expanded world trade. It now appears that overseas growth, rather than being a neutral factor, will bolster U.S. exports.

While this is good news, there are several notes of caution. The current bout of economic strength may tend to divert attention from longstanding, though slowly diminishing, problems. It may appear that the twin U.S. deficits, less-than-desired domestic growth in some industrialized countries (particularly West Germany), and debt and export earnings problems in the developing countries (LDC's) merit less concern than they once did. This view would be wrong. These imbalances still hold significant peril for the current world expansion, particularly in the area of LDC debt.

With this new strength in economic activity comes a quickening in the pace of inflation. On a worldwide basis (exclusive of the United States), the outlook is for inflation almost to double to around 30 percent in 1988. A further jump is expected in 1989, to near 40 percent. While most countries will participate in this trend, Latin America will have by far the most severe problem. In turn, rising inflation and stronger growth have led to an uptick in interest rates in many major industrialized countries, and rates could rise still further.

The rise in interest rates (particularly in the United States), has ushered in a period of strength for the dollar. This is so despite figures that, while improved, continue to indicate a large U.S. trade deficit in 1988, and central bank intervention in currency markets. The dollar's strength is likely to continue through the end of 1988, as real interest differentials remain strongly in favor of dollar-denominated assets and the U.S. economy remains robust. However, the persistence of the U.S. fiscal and trade deficits, and the likelihood that other economies will raise interest rates further

because of inflation fears, suggest that the strength of the dollar will dissolve in the midterm.

## World Economic Activity

### *Developed Country Growth*

The main goal set forth in the Louvre Accord, adopted by the G-7 countries (United States, Japan, West Germany, Canada, United Kingdom, Italy, and France) in February 1987, was the stabilization of exchange rates through the coordination of economic policies, particularly those of the United States, Japan, and West Germany.

There has been spotty success. The recently improving U.S. trade and budget deficits remain large and still require substantial capital flows into the United States. This has aggravated instability in foreign exchange markets, and has crowded out some investment that would have occurred elsewhere.

The trade surplus countries have adopted more stimulative policies. Japan, in particular, has dramatically shifted its economy from exports to domestic demand, while West Germany has adopted some tax cuts for this year and next. These actions, along with the weaker dollar, should lessen their trade surpluses. But Japan, West Germany, the United Kingdom, and perhaps other European countries seem ready to pursue less stimulative policies (witness the already higher interest rates), thus slowing an already slow adjustment in world imbalances. Implicit in all this is the requirement that more balanced growth be pursued by the major countries. This goal, too, has met with mixed success.

Foreign industrial-country growth is placed at about 3.2 percent in 1988 and 2.6 percent in 1989. Japan's economic growth is now expected to reach 5.0 percent in 1988 and 3.9 percent in 1989. Fueled by consumer spending and a major expansion in government public works spending, Japan has managed to achieve more balance between export and domestic growth.

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Recently, import growth has slowed somewhat, further reducing the U.S. trade deficit. While the United States has lowered its budget deficit, it still remains large. The U.S. economic growth rate in 1989 is expected to slow.

Europe also shows an improved forecast for 1988, with expectations for 2.6-percent growth (an upward revision of 0.6 percent). But 1989 expectations remain essentially unaltered at 2.2 percent. Expectations for 1989 are guided by the belief that Germany will narrow its fiscal deficit, while Italy and the United Kingdom, faced with balance-of-payments problems, will slow their growth. Comprising about one-quarter of the EC economy, West Germany is expected to grow only 1.4 percent in 1989.

#### *Developing Country Growth: For Latin America Only 0.1 Percent in 1988*

Despite some improvement, the problems facing the heavily-indebted LDC's remain severe. Though export earnings could rise due to stronger-than-expected world growth and higher commodity prices, the reality is that real prices for the primary-commodity exports of the LDC's remain at very low levels. While the most immediate problems of LDC debt have been dealt with, the fundamental problem of growing debt, made worse by the recent upward movement of interest rates and the drag they cause on investment and growth prospects, has yet to be meaningfully addressed.

The forecast for LDC growth is virtually unchanged at 2.6 percent in 1988 and 3.5 percent in 1989. However, significant changes have been made for countries within the category. In particular, there is a marked deterioration of prospects in Latin America, where growth is now seen as essentially stagnant at 0.1 percent for 1988, but rebounding to 2.4 percent in 1989. The downward revision for 1988 was generated by declining prospects in Mexico and Brazil because of persistent inflation and debt problems.

In contrast, the forecast of Asian economic growth in 1988 has been revised upward by almost 2.0 percentage points to 7.1 percent, but is expected to revert to a more

usual 5.7 percent in 1989. Taiwan, South Korea, Singapore, and Hong Kong account for much of the improvement, with better export performance than other Asian countries. In addition, several other countries in the region (e.g. Thailand, the Philippines, Malaysia, and Indonesia) are showing better export prospects as commodity prices strengthen and manufactured exports rise.

#### *Inflation*

World inflation may worsen in 1988 and 1989. Overall world inflation is expected to rise to 20.6 percent in 1988 (previously forecast at 17.9 percent), and to 25.7 percent in 1989 (up from 13.9 percent). LDC prices will be responsible for the lion's share of this movement, up about 100 percent in 1988 and 134 percent in 1989. Most of the movement in LDC prices comes from Latin America, where inflation is expected to hover near 270 percent in 1988 and accelerate to over 350 percent in 1989. Argentina and Brazil show the largest revisions, as inflation is expected to approach 400 and 800 percent, respectively, in 1989. Previous 1989 forecasts were 300 percent for Argentina and 260 percent for Brazil. In contrast, Asian LDC's are seen with 1988 and 1989 inflation of 6-7 percent, only marginally above previous expectations.

Overall industrial-country inflation, unlike LDC and world inflation, shows little revision and is expected to be about 3-4 percent in 1988 and 1989. However, certain countries, such as the United States, the United Kingdom, and Italy, could face higher inflation if economic growth continues at its present pace.

#### *Commodity Prices*

The strength exhibited by the International Monetary Fund's all-commodities nonfuel price index in 1987 continued through the middle of 1988. On a December-to-December basis, 1987 dollar-denominated prices rose 30.8 percent. From the end of 1987 to June 1988, prices had risen 13.3 percent. For the developing countries index, the December-to-December 1987 increase was 26.8 percent, while the end of 1987-to-June increase was 7.2 percent. This recovery reflected better-than-expected world economic growth, plus short supplies of some commodities, particularly metals. While

these prices have slowed their increase from 1987 levels, they remain favorable for commodity-exporting LDC's.

This continued strength may indicate that prices have passed through their low point and should gain in the future, but they will remain quite depressed in real terms. Real commodity prices (i.e. commodity prices relative to manufactured export prices) were down by almost 2.5 percent in 1987, while LDC real prices declined by about 7.5 percent. For the most part, real commodity prices remain at, or near, 1930's levels.

The outlook does not show any major recovery in real commodity prices, though stronger growth would have an upward influence. Both nominal and real prices are seen rising in 1988 and 1989. At most, and assuming no stronger growth than already expected, gains in real prices will be in the 1-2 percent range for both years. This holds for both the all-commodities and developing-countries indices.

Unlike other commodity prices, oil prices remain low and could be set to fall further. Currently (August 1988), benchmark Saudi light is priced at around \$12.00 per barrel, almost \$5.00 lower than last year. Reports indicate that OPEC production is about 2 million barrels per day beyond current needs. U.S. crude inventories appear high, about 12 percent above a year ago.

## Dollar Exchange Rates

The dollar has entered a significant period of strength, with the Federal Reserve Board nominal dollar index 14.0 percent above 1987 end-of-year values. This stems from higher U.S. interest rates and a marked improvement in the trade deficit, down 15 percent on a seasonally adjusted basis between the first trimesters of 1988 and 1987. But with expectations for a large trade and current account deficit for the next several years, along with an expected narrowing of interest rate differentials, which currently favor U.S. dollar assets, the dollar's strength may well dissolve. Though the dollar could remain strong through the end of the year, the mid-term outlook still shows a modest depreciation.

### Exchange Rates

The dollar was stable over the early part of 1988, but since late April has been generally on the rise. The Fed and other central banks have been intervening to slow the dollar's appreciation. The yen had traded between 124 and 126 to the dollar during early summer, but by September it was back in the 135 range. The mark was trading between 1.68 and 1.72 to the dollar, but later stood at 1.872, having breached 1.9 briefly. These movements represent a dollar appreciation of over 10 and 20 percent against the yen and mark, respectively, since the end of 1987. It seems likely that both the yen and the mark will test the upper bounds of the dollar (believed to be 140 yen and 1.9 marks) set for them by the seven major industrial countries.

### Interest Rates

Interest rates in the United States have been moving upwards, with the Fed making a strong statement by increasing the discount rate 0.5 percent to 6.5 percent. U.S. short-term rates covering overnight lending of reserves between banks (the Federal Funds rate) also have been pushed up by the Fed. Should they remain at current levels—above 8 percent—it would signal the possibility of a further rise in the discount rate. The 3-month Treasury Bill rate has moved to 7.33 percent, over 1 percent above its level a year ago.

European countries, particularly West Germany, have also recently pushed rates up.

World and regional economic growth

Calendar year	1984	1985	1986	1987	1988	1989
Percent change						
World	4.1	3.0	2.8	3.1	3.3	2.9
United States	6.6	3.0	2.8	3.4	3.8	2.8
World less U.S.	3.2	3.0	2.7	2.9	3.1	2.9
Developed countries	4.5	3.1	2.5	3.1	3.5	2.7
Less U.S.	3.4	3.3	2.4	2.9	3.2	2.6
EC-12	2.3	2.4	2.4	2.5	2.6	2.2
Japan	5.1	4.7	2.5	3.9	5.0	3.9
Developing countries	3.1	2.5	2.6	2.9	2.6	3.5
Oil exporters	1.3	-0.1	-2.1	0.9	0.7	1.9
Non-oil exporters	4.4	4.2	5.8	4.3	3.9	4.5
Latin America	3.3	3.6	3.7	2.3	0.1	2.4
Africa & Middle East	1.1	0.0	-1.2	1.2	1.5	2.7
Asia	5.4	4.0	5.8	5.8	7.1	5.7
NIC's	8.9	3.7	9.9	11.1	8.5	6.7
CPE's	3.7	2.9	3.9	3.2	3.2	3.2

Sources: IMF, The WEA Group Inc., ERS.



Non-fuel commodity and manufactures export prices  
(1980=100, U.S. dollar terms)

	1983	1984	1985	1986	1987	December 1987	June 1988
Non-fuel commodity prices							
All commodities	85.6	87.4	76.0	73.1	79.4	92.6	104.9
Developing countries	83.3	86.7	75.6	74.7	77.2	90.3	96.8
Developed countries	87.6	88.1	76.4	71.7	81.5	94.8	111.8
Manufactures export prices							
Developing countries	91.8	90.8	86.5	71.5	79.7 <sup>e</sup>	-	-
Developed countries	89.7	87.5	87.1	99.1	110.0	-	-

Note: e = Full year estimate.

Source: IMF, *World Economic Outlook and International Financial Statistics*.

West Germany raised its discount rate 0.5 percent to 3.5 percent, the second such rise in 2 months. Following suit, the United Kingdom pushed up the base rate 1 percent to 12 percent, with strong speculation that it could rise to 13 percent quite soon. Discount rates were increased 0.5 percent by Switzerland to 3 percent, by Italy to 12.5 percent, and by Austria to 4 percent. [Tim Baxter (202) 786-1706]

## WORLD TRADE AND AGRICULTURAL POLICY

### U.S. Agricultural Trade

Despite the severe drought, the U.S. agricultural trade picture has continued to improve. Rising exports and steady imports have produced a growing positive trade balance. Fiscal 1988 exports are expected to finish the year at \$34 billion and 146 million tons, surpassing fiscal 1987's trade by more than \$6 billion and 16 million tons. With the value of agricultural imports holding steady at \$20.5 billion, the U.S. agricultural trade surplus should climb more than \$6 billion, one of its largest year-to-year gains. Annual export value and volume are expected to remain below peak levels for the foreseeable future, however.

In the last 2 years, improved competitiveness has boosted U.S. agricultural exports nearly 40 percent in volume and 30 percent in value. Since 1986, the U.S. share of world agricultural trade value has rebounded from its 25-year low—12 percent—back toward its long-term average of 16 percent. Higher prices for grains, oilseeds, and other bulk products account for some of this relative

improvement, given the substantially greater importance of bulk exports for U.S. trade value than for world trade value.

But increased competitiveness is the more important factor. A drop in support prices, lower exchange rates for the dollar, and increased use of the Export Enhancement Program (EEP) combined to make U.S. exports more competitive, raising the U.S. share of world grain and oilseed trade volume from 35 percent in 1985/86 to 45 percent during the 1987/88 crop year.

Farm products that are largely unaffected by support prices and the EEP have also benefited from improved competitiveness. U.S. animal product exports are expected to surpass last year's record by \$800 million, reaching \$5.8 billion, and horticultural exports are expected to reach a record \$3.7 billion. These and other high-value products are exported primarily to developed countries, where stronger currencies have sustained import demand since 1986. Altogether, high-value exports are expected to reach a record \$16 billion in 1988.

On the other hand, bulk exports will remain well below the record \$32 billion of 1981. Grains account for most of this decline. In 1988, the value of U.S. grain exports is expected to rise for the first time in 4 years, growing nearly \$3 billion to \$12.2 billion. However, in 1981 the United States exported \$21.4 billion of grains and grain products. Although the U.S. share of world grain and oilseed trade has grown in 1988, it remains well below the 55-percent share held at the start of the 1980's. Foreign producers have proven reluctant to relinquish increased productive capacity in the near term, and higher prices in the wake of the U.S. drought will further delay any trade improvements.

Fiscal 1988 U.S. exports were largely unaffected by the drought, which occurred well after winter's seasonal peak in agricultural exports. Drought-raised prices even added \$400 million to the 1988 coarse grain estimate late in the year. Export value may continue to rise in fiscal 1989 if higher prices offset lower wheat, soybean, and corn export volume. Previous U.S. droughts in the 1980's were followed by increases in export value, and 1981's record \$44 billion in exports followed a drought. But if export value rises

in fiscal 1989 the increase will be slight, and value will remain well below record.

In the near term, higher U.S. and global prices will restrict world trade, boost foreign production, and cut the U.S. share of world trade. In the longer run, a single year of drought-reduced production should not permanently reduce the U.S. presence in world agricultural markets. Although previous U.S. droughts preceded extended U.S. export downturns, general macroeconomic and policy conditions were less favorable to exports at the time than they are expected to be after 1989. [Stephen A. MacDonald (202) 786-1822]

### Fertilizer Markets on the Mend

World fertilizer prices, which reached their lowest point of the decade in 1986, increased in 1987 and continued on an upward trend through the first half of 1988. Only phosphate rock prices stayed low. Fertilizer application per unit of arable land continued to expand steadily, particularly in the developing countries. In the United States, application rates have remained constant since 1985 after declining dramatically in the early

1980's. World fertilizer production expanded in the last few years at a modest rate of just over 2 percent per year. While fertilizer use will continue to expand in the foreseeable future, technical progress in methods of applying fertilizer more efficiently to crops, so as to reduce leaching of nutrients into groundwater supplies, will likely begin to dampen the rate of growth.

The downward swing in world fertilizer prices since 1981 was due to the combined effect of low farm commodity prices, heavy foreign debts in many fertilizer-importing developing countries, the debt problem of U.S. farmers, and excessive fertilizer output and stocks. However, increased demand in major importing countries in 1987 and the first half of 1988 pushed prices up. Urea prices, for instance, jumped from \$107 per ton in 1986 to \$127 in the spring of 1988 due to high demand in China and the Philippines, and to tight supplies before export availabilities increased in the United States and Indonesia. Tight supplies also developed for superphosphate (TSP) and diammonium phosphate (DAP). Exportable supplies for these products increased in the United States, and demand

World fertilizer supply and demand balance, 1987 and projected 1992

	Nitrogen (P)		Phosphate (P)		Potash (K)	
	1987	1992	1987	1992	1987	1992
Million metric tons						
World:						
Supply	74.2	81.3	36.8	41.8	30.3	32.7
Demand	71.2	82.3	33.9	39.3	26.1	29.3
Balance	3.0	-1.0	2.9	2.5	4.2	3.4
Developed market economies:						
Supply	22.2	22.9	17.5	18.9	17.5	18.5
Demand	22.3	23.2	11.5	12.2	11.0	11.6
Balance	-.1	-.3	6.0	6.7	6.5	6.9
Centrally planned Europe:						
Supply	22.9	23.7	9.2	10.0	12.0	13.3
Demand	16.2	18.5	1-.7	11.4	10.2	11.2
Balance	6.7	5.2	-1.5	-1.4	1.8	2.1
Centrally planned Asia:						
Supply	13.1	14.2	2.5	3.2	0	.1
Demand	15.1	17.6	3.0	4.5	.8	1.3
Balance	-2.0	-3.4	-.5	-1.3	-.8	-1.2
Developing market economies:						
Supply	16.1	20.5	7.5	9.7	.7	.9
Demand	17.7	23.0	8.7	11.2	4.0	5.2
Balance	-1.6	-2.5	-1.2	-1.5	-3.3	-4.3

Source: FAO, Current World Fertilizer Situation and Outlook, 1985/86-1991/92 (Rome: 1987).



remains strong in China, India, Pakistan, and some other countries.

In the case of potash fertilizers, the price of potassium chloride increased from \$72 per ton in 1986 to \$82 in mid-1988 and is likely to remain firm. In early January the United States agreed to suspend antidumping duties for 5 years, in exchange for Canadian producers' promise to maintain potash prices above the cost-of-production estimates.

Phosphate fertilizer supplies remain tight, despite low rock phosphate prices, because of relative scarcity and high prices of phosphoric acid. Hence, some phosphate fertilizer plants in India have been forced to close down. Still, Jordan is developing a major new phosphate mine, and Morocco is expanding its phosphate fertilizer industry, even though the decline of Western Europe's phosphate fertilizer industry is likely to keep prices down.

During the last few years, the fertilizer industry has been undergoing far-reaching structural changes, at least in the industrialized countries. Stress is being placed on least-cost materials that can be produced in large plants and transported as intermediate products to final processors. These products include ammonia, urea, urea-ammonium nitrate solution, phosphoric acid, ammonium phosphates, triple superphosphate, and potash. They are produced by fewer, and presumably stronger, producers who operate with reduced supply inventories to cut costs. On the other hand, recently the U.S. Department of Transportation attempted to reclassify anhydrous ammonia as poisonous gas, and

many countries have made repeated attempts to control the leaching of fertilizer from soil to prevent pollution of surface and subsurface waters. These tighter regulations are likely to keep pushing fertilizer prices up.

According to World Bank and FAO studies, phosphate and potash fertilizer supplies will be adequate over the next few years, with a substantial excess capacity in the industry. However, shortages are likely to develop in nitrogen fertilizers. This is welcomed by the industry, which sees the present overcapacity as discouraging adequate investment in large ammonia plants to meet the strong growth in demand.

On a regional basis, the developed market economies will remain almost self-sufficient in fertilizer production, though small quantities of nitrogen fertilizers will be imported from Eastern Europe. Eastern European countries will remain short of phosphate fertilizers and will need to import about 1.4 million tons annually. The developing market economies and centrally-planned Asian countries, principally mainland China, will remain increasingly large importers of all fertilizers. *[Francis Urban (202) 786-1705]*

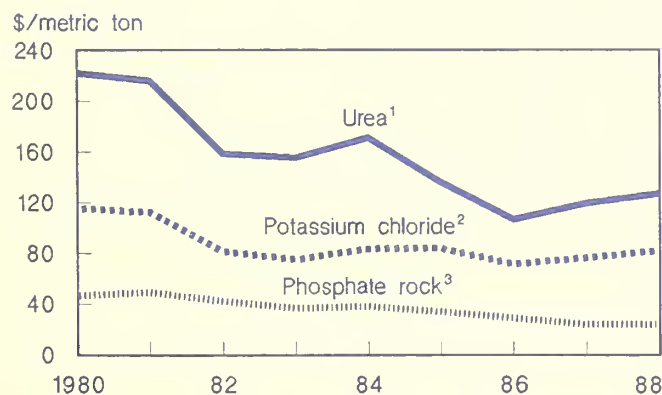
### Impact of Severe U.S. Drought

U.S. grain production in 1988 was forecast at 191 million tons, 31 percent below 1987, in a September 12 USDA assessment. The assessment, based on farm surveys conducted in late August and early September, confirmed earlier estimates of the impact of severe summer drought over much of the U.S. agricultural heartland.

Total supplies of grain, which take into account the large stocks at the beginning of the season, were forecast at 366 million tons, down 24 percent from a year ago.

The corn crop was estimated at 4.46 billion bushels, down 37 percent from 1987. The average yield per harvested acre was 78.5 bushels, compared with 119.4 bushels in 1987, a decline of 34 percent. The drought-induced reduction in yield was the largest on record, exceeding the 28-percent decline recorded in 1983, another drought year.

### International Fertilizer Prices



Prices in current U.S. dollars. 1988 preliminary. 1/ Bagged, f.o.b. Amsterdam. 2/ Bulk, f.o.b. Vancouver. 3/ Price of 70-percent BPL rock, f.a.s. Casablanca. Source: World Bank, *Price Prospects for Major Primary Commodities*, Oct. 1986, and *Quarterly Review of Commodity Markets*, Apr. 15 and July 11, 1988.



International commodity prices

Year	Wheat				Corn		Soybeans	Soyoil	Soymeal 44%	
	U.S. 1/	Arg. 2/	Can. 3/	Aust. 4/	U.S. 5/	Arg. 2/	U.S. 5/	U.S. 6/	U.S. 6/	Ham.7/
Dollars per metric ton										
1980	176	203	192	175	129	159	272	522	217	271
1981	176	190	194	175	135	139	272	464	223	269
1982	161	166	165	160	110	109	233	404	197	233
1983	158	138	167	161	137	133	269	518	222	255
1984	153	135	166	153	138	132	271	678	184	210
1985	137	106	173	141	114	103	214	596	140	171
1986	117	88	161	120	89	83	200	361	174	197
1987	114	89	134	115	77	80	204	349	194	215
1988										
Jan.	130	94	148	127	87	85	237	477	213	239
Feb.	132	106	151	135	88	86	237	458	203	233
Mar.	126	107	143	131	91	85	241	443	211	247
Apr.	128	108	145	133	90	81	254	474	220	258
May	130	107	152	131	90	79	271	516	247	275
June	151	125	166	158	118	121	345	606	320	336
July	151	141	213	157	130	131	335	646	284	311

1/ No. 2 hard winter, ordinary protein, f.o.b. Gulf ports. 2/ F.o.b. Buenos Aires. 3/ No. 1 western red spring, 13.5% protein, in store Thunder Bay. 4/ July-June crop year, standard white, f.o.b. selling price. 5/ U.S. No. 3 yellow, f.o.b. Gulf ports. 6/ Decatur. 7/ Hamburg, f.o.b. ex-mill.

Soybean production was estimated at 1.47 billion bushels, 23 percent below 1987. Soybean yields were expected to be 25.9 bushels per acre, compared with 33.7 bushels in 1987.

Other spring-planted crops suffered major losses. Durum wheat production was estimated at 49.2 million bushels, down 47 percent from 1987. Other spring wheat, at 206 million bushels, was down 54 percent from 1987; sorghum, at 540 million bushels, was down 27 percent; barley, at 287 million bushels, was down 46 percent; and oats, at 206 million bushels, were down 45 percent. On the other hand, winter wheat, which normally accounts for the bulk of U.S. wheat

production, totaled an estimated 1.55 billion bushels, about the same as in 1987.

U.S. food grain production has been on a downward trend since the peak of 1981 (cover chart), mainly because of Government programs intended to cut overproduction. In light of this, what the 1988 summer drought did was to prolong the downward trend, albeit in a way no one could have anticipated. Nevertheless, total supplies remain high enough in most cases to assure an adequate food supply at home, satisfy foreign customers, and meet food aid commitments. [Arthur J. Dommen (202) 786-1884]

## MARKET SHARES OF WORLD TRADE IN CORN, SOYBEANS, AND WHEAT

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**Abstract:** A market share analysis of world trade in corn, soybeans, and wheat reveals surprising stability in terms of relative volumes traded between trading partners over two consecutive 6-year periods. This article uses United Nations data covering 1974-79 and 1980-85 to compare trade between major exporters and importers of these crops.

**Keywords:** Exports, imports, market share, corn, soybeans, wheat.

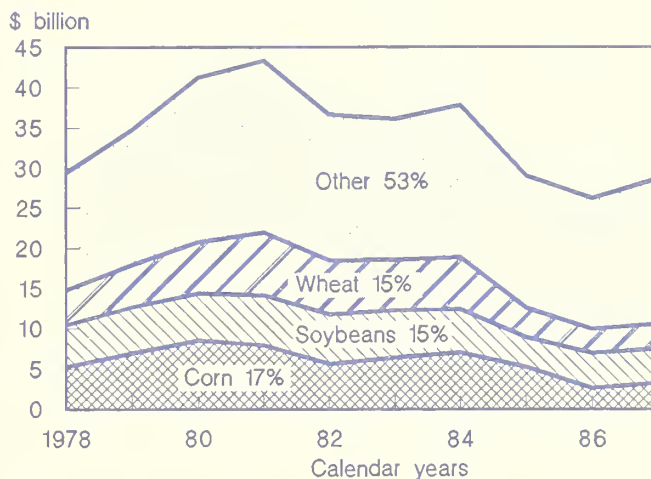
Corn, soybeans, and wheat composed nearly half the value of U.S. agricultural exports over the past decade (1978-87), excluding the export value of byproducts (figure 1). Given the importance of these three crops to the balance of U.S. agricultural trade, this article identifies the major exporters and importers and their market shares for these commodities. It also discusses the outlook for these major markets.

Country import data reported to the United Nations for calendar years 1974-85 are reflected in tables 1-3. These tables identify and rank the four major exporters and the eight major importers for each crop in 1980-85, and show the trade flows between each exporter and importer in terms of 6-year averages for 1974-79 and 1980-85. Together, these countries accounted for 74 percent of world corn imports and 87 percent of world corn exports; 86 percent of world soybean imports and 95 percent of world soybean exports; and 63 percent of world wheat imports and 89 percent of world wheat exports in 1980-85. 1/

The tables are so arranged that each exporter's share in the market of each importer and each importer's sharewise source of supply can be read directly from the appropriate column and row.

1/ In the case of the EC-10, country trade data have been aggregated so as to account for intra-EC trade. The important intra-EC trade in different types of wheat explains why the EC-10 appears as both an exporter and an importer in table 3.

Figure 1  
**Value of U.S. Agricultural Exports**



A surprising degree of stability in world trade in these crops emerges when comparing the two 6-year periods. The most dramatic changes between 1974-79 and 1980-85 were:

---A rise in the USSR's share of wheat imports, from 11 percent to 21 percent, amounting to a 91-percent change in market share;

---A drop in the EC-10 countries' share of corn imports, from 32 percent to 17 percent, amounting to a 47-percent change in market share;

---A rise in the EC-10 countries' share of wheat exports, from 13 percent to 18 percent, amounting to a 38-percent change; and

---A drop in the EC-10 countries' share of soybean imports, from 48 percent to 41

percent, amounting to a 15-percent change in market share.

Shifts of this magnitude indicate some sort of structural change in demand and/or supply. While market shares have in most instances remained surprisingly stable, the total quantities traded have increased. As compared with this longer-term stability, however, the annual data show a considerable amount of instability, meaning that both exporters and importers vary their markets and suppliers freely in accordance with economic and other conditions. Figures 2-4 show annual exports of these three crops by exporter for calendar years 1977-86, giving an idea of the year-to-year instability.

### *U.S. Leads in Corn Exports*

During calendar years 1980-1985, U.S. corn exports averaged over 50 million tons annually, nearly 75 percent of the world export total (figure 2). Argentina ranked second with 9 percent of exports, followed by Thailand with 3 percent. The Republic of South Africa ranked fourth with less than 3 percent.

Although U.S. corn exports grew by 18 percent between the two periods, the U.S. share of world exports declined slightly from 1974-79 to 1980-85 as Argentina, Thailand, and other exporters boosted their market shares (table 1).

Argentine 1980-85 corn exports averaged more than 6 million tons, nearly 25 percent more than during 1974-79, reflecting higher production.

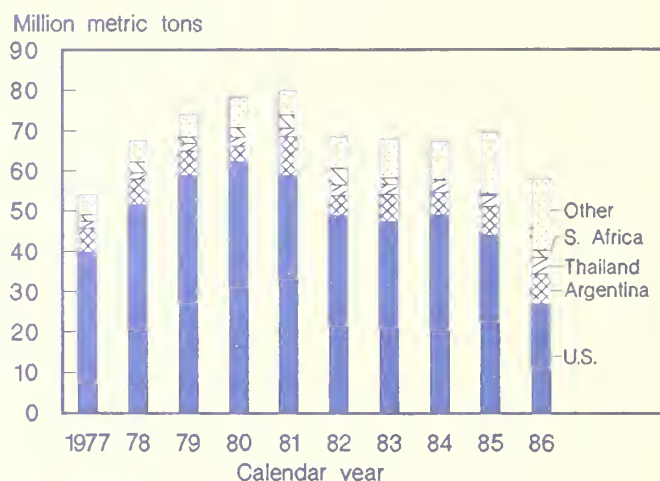
Thailand boosted corn exports 25 percent from 1974-79 to 1980-85, successfully defending its 3-percent share of the world market.

South Africa's share of world corn exports dropped about 1 percentage point from 1974-79 to 1980-85, as drought reduced yields, production, and exports in the early 1980's.

### *Japan Surpasses EC as Top Corn Importer*

During 1980-85, Japan was the leading corn importer, taking nearly 20 percent of the world's imports, up from 15 percent for 1974-79. The EC-10 and the USSR were close

Figure 2  
**World Corn Exports**



behind, each buying around 16.5 percent of global corn imports during 1980-85. As the major corn exporter, the United States is the largest supplier of corn to the world's major markets (Japan, the EC, and the USSR), which collectively took over half of U.S. corn exports during 1980-85.

Japan's corn production is inconsequential, less than 3,000 tons in 1985. Most is harvested not as a grain, but as green chop for silage. Corn imported for use in formula feed is exempt from duty. All other corn is subject to tariffs or a tariff quota to protect various domestic industries, such as potato producers (starch) and bonded feed mills, which places a slight tax on consumption (4). 2/ Japan's imports of corn have continually grown, reaching nearly 15 million tons in 1983 (and a projected 17 million in 1988). The United States has been the main supplier, furnishing around 90 percent of Japan's 1980-84 corn imports; since then, the U.S. share has remained below 90 percent as Japan expanded purchases from Argentina and China.

The EC-10 led in corn imports during 1974-79, taking 32 percent of the world total. Much of the drop in the EC-10 countries' share to 17 percent in 1980-85 results from displacement of corn imports by relatively lower priced nongrain feeds, such as manioc and corn gluten feed, as well as increased

2/ Numbers in parentheses refer to references at end.



Table 1--World corn trade, annual averages and market shares, 1974-79 and 1980-85 1/

Importers	Exporters										Total	
	United States 1974-79	United States 1980-85	Argentina 1974-79	Argentina 1980-85	Thailand 1974-79	Thailand 1980-85	South Africa 1974-79	South Africa 1980-85	Other 1974-79	Other 1980-85	1974-79	1980-85
Japan	7,270	12,151	55	103	681	79	840	977	288	539	9,134	13,848
% of importer's imports	80	88	1	1	7	1	9	7	3	4	100	100
% of exporter's exports	17	24	1	2	35	3	39	50	4	6	15	19
EC-10	12,746	6,184	1,930	586	--	12	436	170	3,818	4,903	18,930	11,855
% of importer's imports	67	52	10	5	--	--	2	1	20	41	100	100
% of exporter's exports	29	12	39	9	--	--	20	9	55	54	32	17
USSR	7,172	7,163	910	3,462	8	185	0	0	578	904	8,669	11,714
% of importer's imports	83	61	11	30	--	2	0	0	7	8	100	100
% of exporter's exports	16	14	18	56	--	8	0	0	8	10	15	16
Spain	2,752	3,545	900	481	0	0	74	19	387	258	4,113	4,303
% of importer's imports	67	82	22	11	0	0	2	--	9	6	100	100
% of exporter's exports	6	7	18	8	0	0	3	1	6	3	7	6
South Korea	1,236	2,705	5	9	40	101	15	29	7	286	1,301	3,131
% of importer's imports	95	86	--	--	3	3	1	1	1	9	100	100
% of exporter's exports	3	5	--	--	2	4	1	1	--	3	2	4
Taiwan	1,087	2,408	29	8	252	87	388	357	98	7	1,854	2,867
% of importer's imports	59	84	2	--	14	3	21	12	5	--	100	100
% of exporter's exports	2	5	1	--	13	4	18	18	1	--	3	4
Mexico	1,195	2,636	178	28	0	0	27	0	59	1	1,458	2,664
% of importer's imports	82	99	12	1	0	0	2	0	4	--	100	100
% of exporter's exports	3	5	4	--	0	0	1	0	1	--	2	4
Portugal	1,300	2,230	32	8	0	0	32	5	37	--	1,402	2,244
% of importer's imports	93	99	2	--	0	0	2	--	3	--	100	100
% of exporter's exports	3	4	1	--	0	0	2	--	1	--	2	3
Other	8,945	12,477	972	1,532	945	1,963	329	384	1,666	2,205	12,857	18,561
% of importer's imports	70	67	8	6	7	11	3	2	13	12	100	100
% of exporter's exports	20	24	19	25	49	81	15	20	24	24	22	26
Total	43,703	51,498	5,011	6,217	1,927	2,427	2,140	1,941	6,936	9,103	59,718	71,186
% of importer's imports	73	72	8	9	3	3	4	3	12	13	100	100
% of exporter's exports	100	100	100	100	100	100	100	100	100	100	100	100

-- = less than 0.5 percent. 1/ Quantities in 1,000 metric tons. For example, Japan's 1974-79 average annual imports of 7.3 million tons of corn from the United States (column 1, row 1) represented 80 percent of Japan's total corn imports (column 1, row 2) and 17 percent of total U.S. corn exports (column 1, row 3). Percentages may not add because of rounding.

Source: (15).

feeding of domestically grown wheat and EC nongrain feeds such as pulses and various byproducts. EC imports of nongrain feeds grew at an annual rate of 13 percent between 1970 and 1982, from 3.7 million tons to 16.2 million. In 1986, the United States was the largest supplier of nongrain feeds to the EC (7). (Spain and Portugal joined the EC-10 in 1986 to form the EC-12.)

Soviet agricultural imports prior to 1970 were kept to a minimum because of the emphasis on agricultural self-sufficiency in the Soviet Union. Through the 1970's and early 1980's, however, the USSR increased its imports of grains and other agricultural commodities. The change was due in part to slow growth in domestic production, and in part to increased hard currency earnings from oil and gas exports to the West.

The Soviet self-sufficiency goal, however, has acquired new significance since the mid-1980's because of declining export earnings and the experience with the U.S. grain embargo (9). The Soviets are attempting to limit their expansion of domestic grain use, thereby reducing their import dependence. Feed use has accounted for nearly all the increase in Soviet grain use since 1965. Until recently, attempts to save on feed use of grain focused on substituting roughages for grain in ruminant feed rations, rather than on increasing the availability of protein concentrates. Between 1979 and 1984, there was no increase in Soviet grain feeding despite a 10-percent increase in livestock production. Most of the grain savings came in ruminant rations.

Since 1985, the Soviets have increased protein imports, which should also save on grain in feed rations. Although USSR corn imports since 1974 have varied widely from year to year, the USSR was second only to Japan as a U.S. corn market for 1980-85, and nearly tied with the EC as the second-largest world market for corn.

Spain, South Korea, Mexico, Taiwan, and Portugal each took less than 7 percent of U.S. corn exports during 1980-85, and 6 percent or less of global corn imports. South Korea, Mexico, and Taiwan more than doubled their average annual imports of U.S. corn from 1974-79 to 1980-85. U.S. corn exports to

South Korea and Taiwan, two rapidly growing economies, have continued to rise.

### *U.S. Dominates World Soybean Exports*

U.S. soybeans supplied 80 percent of the world's 1974-79 imports and 79 percent of those in 1980-85 (table 2). Brazil and Argentina together provided around 15 percent in 1974-85, and China supplied 1-2 percent.

Brazil maintains a minimum price support program and provides loans, at below-market interest rates, to farmers to finance crop production costs and crop storage. Because of economic difficulties in recent years, funds for these loans have been reduced, and interest rates charged farmers have been increased until the rates are close to the Government's cost of borrowing. Brazilian policies — especially research programs, input subsidies (which have been phased out), and subsidized credit — have successfully aided the great expansion of cash crops in the nation's southern part. Soybean production expanded from less than 1 million tons in 1969 to over 18 million in 1985 (1).

During the 1980's, taxes and Government intervention in the Brazilian market likely reduced growth in soybean production, domestic supply, and exports (13). In Brazil, about 20 percent of soybeans are double-cropped with wheat (12). In Brazil and Argentina, soybean exports are taxed at higher rates than soybean meal and soybean oil exports in order to generate revenue and encourage sales to the domestic crushing

Figure 3  
**World Soybean Exports**

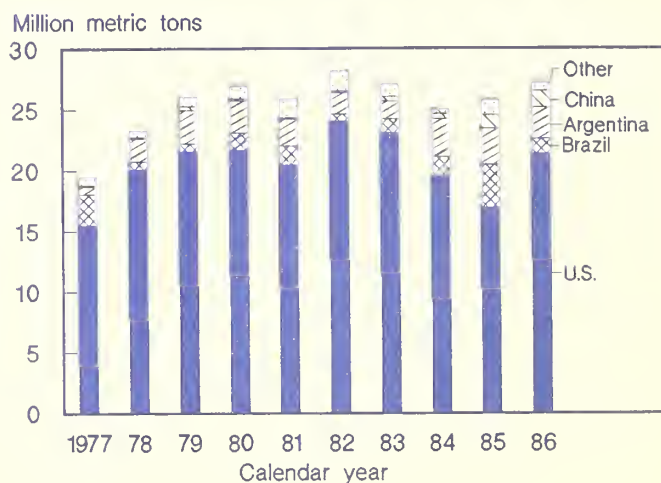


Table 2--World soybean trade, annual averages and market shares, 1974-79 and 1980-85 1/

Importers	Exporters												Total
	United States		Brazil		Argentina		China		Other				
	1974-79	1980-85	1974-79	1980-85	1974-79	1980-85	1974-79	1980-85	1974-79	1980-85			
EC-10	7,436	8,518	1,171	651	651	1,097	10	0	592	644	9,860	10,910	
% of importer's imports	75	78	12	6	7	10	--	0	6	6	100	100	
% of exporter's exports	45	41	54	42	73	46	4	0	74	53	48	41	
Japan	3,443	4,269	52	47	3	12	175	202	14	31	3,688	4,560	
% of importer's imports	93	94	1	1	--	--	5	4	--	1	100	100	
% of exporter's exports	21	20	2	3	--	--	73	48	2	2	18	17	
Spain	1,393	2,071	374	433	104	118	0	0	49	143	1,919	2,765	
% of importer's imports	73	75	19	16	5	4	0	0	3	5	100	100	
% of exporter's exports	8	10	17	28	12	5	0	0	6	12	9	10	
Taiwan	815	1,226	0	0	0	0	0	0	--	12	815	1,238	
% of importer's imports	100	99	0	0	0	0	0	0	--	1	100	100	
% of exporter's exports	5	6	0	0	0	0	0	0	--	1	1	5	
USSR	627	271	394	175	5	562	0	119	0	8	1,026	1,135	
% of importer's imports	61	24	38	15	--	49	0	10	0	1	100	100	
% of exporter's exports	4	1	18	11	1	24	0	29	0	1	5	4	
Mexico	365	749	31	96	21	130	0	0	14	0	432	975	
% of importer's imports	85	77	7	10	5	13	0	0	3	0	100	100	
% of exporter's exports	2	4	1	6	2	5	0	0	2	0	2	4	
South Korea	173	628	0	15	0	0	0	0	2	2	176	645	
% of importer's imports	99	97	0	2	0	0	0	0	1	--	100	100	
% of exporter's exports	1	3	0	1	0	0	0	0	--	--	1	2	
Portugal	125	401	14	82	5	64	0	0	--	1	145	549	
% of importer's imports	86	73	10	15	4	12	0	0	--	--	100	100	
% of exporter's exports	1	2	1	5	1	3	0	0	--	--	1	2	
Other	2,010	2,766	149	60	97	381	54	96	127	380	2,437	3,682	
% of importer's imports	83	75	6	2	4	10	3	3	5	10	100	100	
% of exporter's exports	12	13	7	4	11	16	22	23	16	31	12	14	
Total	16,388	20,901	2,185	1,558	885	2,363	239	416	780	1,220	20,497	26,459	
% of importer's imports	80	79	11	6	4	9	1	2	4	5	100	100	
% of exporter's exports	100	100	100	100	100	100	100	100	100	100	100	100	

-- = less than 0.5 percent. 1/ Quantities in 1,000 metric tons. For example, the EC-10's 1974-79 average annual imports of 7.4 million tons of soybeans from the United States (column 1, row 1) represented 75 percent of the EC-10's total soybean imports (column 1, row 2) and 45 percent of total U.S. soybean exports (column 1, row 3). Percentages may not add because of rounding.

Source: (15).



industry, thereby increasing the value added before exporting.

In Argentina, crop rotation schemes were recently changed to double-crop wheat and soybeans continuously (8). Argentina's soybean exports have grown rapidly since 1975, doubling the country's share of world exports between 1974-79 and 1980-85.

China's soybean exports rose continuously since 1982 by a substantial volume, boosting China's market share from just over 1 percent in 1974-79 to nearly 2 percent in 1980-85.

#### *EC Remains Major Soybean Importer*

The largest soybean importer, the European Community, has generally been reducing imports of soybeans since 1982's high of over 12 million tons. EC imports of U.S. soybeans, nearly 11 million tons that year, declined through 1985 as a result of increased EC production of substitutable oilseeds, competition in soybean shipments from Argentina and Brazil, and a strong dollar.

The second largest soybean importer, Japan, increased its imports of soybeans from over 3 million tons in 1974 to nearly 5 million in 1985. Soybeans, the most important source of vegetable protein and vegetable oil for the Japanese, are widely consumed as tofu (soybean cake), miso (soybean paste for soup), shoyu (soysauce), and other processed forms in addition to soybean oil (11). Nearly 80 percent of total soybean consumption is in the form of livestock feed.

Although deficiency payments for soybean production began when import quotas were abolished in 1961, Japan's domestic production declined to a very low level until the mid-1970's. When the "food crisis" of the early 1970's and the U.S. embargo of soybean exports in 1973 resulted in short supply, prices in Japan skyrocketed. Consequently, public opinion in Japan moved strongly in favor of domestic production regardless of higher costs, and the Government began to encourage production through subsidies and higher support prices. Although domestic production is higher, it accounts for only a small part of total consumption. More than 4 million tons of soybeans, used mainly for meal for livestock and oil for food, are imported duty free (11).

While Spain took around 10 percent of world and U.S. soybean exports in 1974-85, Taiwan, the USSR, Mexico, South Korea, and Portugal averaged less than 6 percent. All of these markets increased their soybean imports from 1974-79 to 1980-85, and all except the USSR increased imports of U.S. soybeans.

#### *U.S. First in Wheat Exports*

The United States led in wheat exports during 1980-85 with 39 percent of the world total (table 3). Canada was second with 20 percent. Although U.S. wheat exports grew 29 percent between the two periods, the U.S. share of world exports declined as Canada and the EC-10 expanded their market shares.

The EC-10 was the third largest wheat exporter in 1980-85, primarily because of exports from France. The EC share of the world market rose from 13 percent in 1970-74 to 18 percent in 1980-85. Excluding intra-EC trade would probably place the EC-10 after Australia in the ranking for wheat exports, however.

Australia, with 12 percent, was the fourth largest wheat exporter in 1980-85, and lost less than 1 percentage point of its 1974-79 market share.

#### *USSR Imported the Most Wheat*

The USSR, the largest wheat importer during 1980-85, was also one of the most volatile buyers. USSR wheat imports ranged from 3 to 26 million tons from 1974 to 1984.

Figure 4  
**World Wheat Exports**

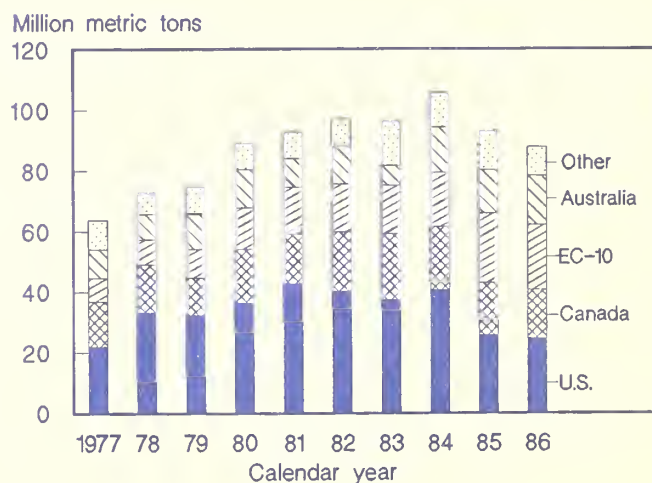


Table 3--World wheat trade, annual averages and market shares, 1974-79 and 1980-85 1/

Importers	Exporters										Total	
	United States 1974-79	United States 1980-85	Canada 1974-79	Canada 1980-85	EC-10 1974-79	EC-10 1980-85	Australia 1974-79	Australia 1980-85	Other 1974-79	Other 1980-85	1974-79	1980-85
USSR	3,118	3,953	2,002	6,046	1	2,749	1,064	2,012	1,000	5,086	7,185	19,847
% of importer's imports	43	20	28	30	--	14	15	10	14	26	100	100
% of exporter's exports	11	11	16	32	--	16	12	17	12	46	11	21
China	965	4,745	2,285	3,210	49	439	1,994	1,560	323	756	5,616	10,709
% of importer's imports	17	44	41	30	1	4	36	15	6	7	100	100
% of exporter's exports	3	13	18	17	1	3	23	13	4	7	8	11
EC-10	2,034	1,723	2,371	2,083	5,901	6,703	45	7	375	60	10,725	10,575
% of importer's imports	19	16	22	20	55	63	--	--	4	1	100	100
% of exporter's exports	7	5	19	11	66	40	1	--	5	1	16	11
Japan	3,221	3,363	1,391	1,367	0	0	1,053	991	5	1	5,671	5,722
% of importer's imports	57	59	25	24	0	0	19	17	--	--	100	100
% of exporter's exports	11	9	11	7	0	0	12	8	--	--	8	6
Brazil	1,572	2,553	859	1,311	63	63	0	0	596	479	3,090	4,405
% of importer's imports	51	58	28	30	2	1	0	0	19	11	100	100
% of exporter's exports	5	7	7	7	1	--	0	0	7	4	5	5
Egypt	1,160	1,764	118	260	434	442	1,009	1,742	280	54	3,000	4,261
% of importer's imports	39	41	4	6	14	10	34	41	9	29	100	100
% of exporter's exports	4	5	1	1	5	3	12	15	3	--	4	4
Poland	662	113	456	706	218	1,164	17	0	878	797	2,231	2,781
% of importer's imports	30	4	20	25	10	42	1	0	39	29	100	100
% of exporter's exports	2	--	4	4	2	7	--	0	11	7	3	3
South Korea	1,647	1,903	6	14	--	9	3	266	--	14	1,657	2,207
% of importer's imports	99	86	--	1	--	--	--	12	--	1	100	100
% of exporter's exports	6	5	--	--	--	--	--	2	--	--	2	2
Other	14,524	17,028	3,134	3,969	2,240	5,364	3,503	5,166	4,832	3,721	28,233	35,248
% of importer's imports	51	48	11	11	8	15	12	15	17	11	100	100
% of exporter's exports	50	46	25	21	25	32	40	44	58	34	42	37
Total	28,905	37,148	12,624	18,968	8,907	16,935	8,690	11,745	8,289	10,966	67,415	95,761
% of importer's imports	43	39	19	20	13	18	13	12	12	11	100	100
% of exporter's exports	100	100	100	100	100	100	100	100	100	100	100	100

-- = less than 0.5 percent. 1/ Quantities in 1,000 metric tons. For example, the USSR's 1974-79 average annual imports of 3.1 million tons of wheat from the United States (column 1, row 1) represented 43 percent of the USSR's total wheat imports (column 1, row 2) and 11 percent of total U.S. wheat exports (column 1, row 3). Percentages may not add because of rounding.

Source: (15).

During 1980–85, the USSR purchased most of its wheat from Canada, while the United States was the next largest source.

Second-ranking China has rapidly raised output as well as productivity since implementing rural reforms after 1978. Starting in 1979, the Chinese Government embarked on a revolutionary program to reorganize farm production units and change rural institutions to revitalize the rural economy. The program included disbanding the commune system and instituting a contract system in which farm households could make economic decisions and allocate resources to raise output, reduce costs, and maximize income (14). These gains in productivity have been accompanied by a greater willingness to rely on world markets for the import of staples such as wheat. Chinese farmers are taking advantage of their new freedom to switch to production of more profitable crops such as fruits and vegetables. (Lower world wheat prices in 1987 were also a factor behind Chinese imports.)

The EC-10 was the third largest wheat importer during 1980–85, taking 11 percent of the world's imports. EC-10 imports were fairly constant at 10–11 million tons for 1974–1984, but rose to 13 million tons in 1985.

Japan, the fourth largest wheat importer in 1980–85, subsidizes domestic wheat production through Government purchases at supported prices and then sells the wheat at lower prices, creating a deficit in that account. Conversely, Government purchases of imported wheat often produce gains, as they are sold at higher prices to millers and feed processors. Wheat importers must apply for Government approval and sell all imported wheat to the Government at the price set by the Government. Imports provide about 90 percent of the wheat consumed (11).

Brazil, Egypt, and Poland each took less than 5 percent of world wheat imports in 1974–85. Brazil and Egypt expanded wheat imports sufficiently to maintain their market share of around 4.5 percent, but Poland's wheat imports declined from 3.6 million tons in 1982 to 1.7 million in 1985. South Korea increased its volume of wheat imports from 1974–79 to 1980–85, but not enough to change its market share.

## *U.S. Market Share in Corn May Slip*

U.S. corn export volume will rise for the second year in a row in calendar 1988 to over 40 million tons. Volume may decline somewhat in 1989 because of higher prices due to the drought-reduced 1988 crop and increased supplies from competitors. This suggests a declining U.S. market share through 1989. Thus, U.S. corn exports from 1986 through 1989 will likely average below the 51.5 million tons of 1980–85.

Argentine corn exports in calendar 1986 exceeded 7 million tons, but fell to around 4 million in 1987 and will likely be around 4 million in 1988, because of declines in harvested area. Soybean area rose in response to higher soybean/corn price ratios in 1987 and 1988 (2). Corn planted area is expected to rise with higher prices in 1988, and Argentine exports are projected to increase in 1989. As 1986–89 Argentine corn exports average below those of 1980–85, Argentina's share of the world's corn exports will slip from its 9 percent for 1980–85.

Thailand's corn exports were nearly 4 million tons in 1986, but fell sharply in 1987 as a result of drought. Exports should strengthen in 1988 and may go higher in 1989. Thailand may continue to expand its corn exports enough to maintain a constant share of the world export market.

South Africa's corn exports since 1985 have not averaged more than the 1.9-million-ton 1980–85 average, and the South African share of world corn exports is not expected to grow in the next few years because South African costs tend to be above world prices. South Africa may have difficulty even maintaining its market share.

## *U.S. Likely To Maintain Market Shares in Soybeans, Wheat*

In 1986 and 1987, U.S. soybean shipments benefited from high crush margins in Europe, as well as a declining dollar. The EC, the world's largest importer of oilseeds and oilseed products, and the largest market for U.S. soybean exports, is fast increasing its self-sufficiency in vegetable oil and protein meals. EC oilseed production has more than doubled since 1983. It has increased tenfold in



the past decade, and now accounts for an estimated one-half of domestic use, the highest ever (10). Overall, U.S. soybean exports in calendar 1988 could decline, a result of shortened supplies and increasing prices.

Brazilian soybean exports in calendar 1986 were below the 1980-85 average, but doubled that average in 1987 and 1988. Brazil has considerable potential to expand soybean production because of vast land resources. Argentina is also increasing soybean production. Argentine soybean exports in calendar 1987 were below the 1980-85 average, but are expected to surpass that level in 1988 and 1989.

Brazilian and Argentine capacity to expand soybean production, particularly at production costs competitive with the United States, may cause the United States to gradually lose some of its share of the world soybean market to Argentina and Brazil in the years ahead (12). The U.S. share of world soybean exports varied from 67 percent to 86 percent during 1974-85, and is difficult to predict for any given year.

The rising trend of China's soybean exports is expected to reverse if higher domestic demand trims exports to about 0.5 million tons annually during 1994-2000 (5). China's population growth rate is low compared with other developing countries, but consumer purchasing power has been rising rapidly.

U.S. wheat exports, down in calendar 1985 and 1986 to less than 25 million tons, were over 30 million in 1987, and may exceed 40 million in 1988. Lower U.S. loan rates and the Export Enhancement Program have improved U.S. competitiveness in world wheat markets.

Canada reduced wheat area in 1987 in response to low world prices. Yields fell also, and output dropped about 16 percent. Exports, however, exceeded 22 million tons. Canadian wheat output in 1988 will be down because of dry weather, and exports will decline also.

EC-10 wheat exports of 22.2 million tons in 1985 and 21.5 million tons in 1986 surpassed those of Canada and Australia. However, EC-10 wheat exports of 21.7 million tons in

1987 3/ were exceeded by Canada's 22.1 million tons. EC-10 wheat yields and production in 1988 may be the largest since 1984, which will support 1988 exports.

Australian wheat exports dropped from over 16 million tons in 1986 as harvested area declined in response to lower price expectations. Australia's wheat exports in 1987 were 15 million tons, and may fall to 10-11 million tons in 1988 because of a smaller 1987 crop. However, Australia is forecast to increase area in 1988 because of some movement back to wheat in response to higher wheat prices.

The contrasting rise in U.S. wheat exports in 1987 and 1988 means that the United States should be able to maintain its 1980-85 share of the world wheat market in the near term. In the longer term, however, the ability of the United States to maintain its market shares will depend on its ability to continue to produce corn, soybeans, and wheat at low costs relative to those of competing exporters. Government intervention in exporting countries also affects competitiveness, and subsidies for producers or exporters can distort fundamental differences in production costs. Consequently, reduction of trade-distorting policies among major exporters may permit lower-cost producers to expand their market shares.

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3/ Including intra-EC trade, as before.

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# BROILER TECHNOLOGY SHIFTS THIRD WORLD TRADE IN POULTRY AND GRAIN

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**Abstract:** The industrialization of Third World poultry production is shifting trade patterns, substituting imports of grains for imports of chicken meat. This substitution occurs as countries increase grain imports to provide adequate feed supplies for their rapidly growing broiler industries.

**Keywords:** Poultry, feed grains, Third World, production, consumption, trade.

Modern technology and trade have internationalized chicken production in the Third World. For example, the grandparents of a broiler raised in Saudi Arabia may be from Europe, the corn in his ration from the United States, and the soybean meal from Brazil. The automated feeding equipment that delivers the ration may be from the United States. The Saudi Arabian family that eats this broiler probably used to eat chicken imported from Western Europe and the United States.

The rapid growth of poultry production is a key reason the Third World has become a net importer of coarse grains (table 1). Imported grain is needed to supply the Third World's rapidly expanding broiler industries. Continued expansion of poultry will likely create even more markets for grain-exporting countries.

The expansion of broilers, even to countries short on feed, shows that modern

poultry production is not linked to land and climate as is crop agriculture. Raising broilers has become an industrial activity, the final step in the production process. The first step includes grain producers and foundation poultry breeders. The grain and breeding stock they produce are inputs for feed manufacturing and hatching egg operations. The rations and chicks are the inputs for the final step, raising the chicks to market weight. Because grain and breeding stock are easily transported, broilers can be efficiently raised almost anywhere using modern technology.

The broiler industry is relatively new. Sixty years ago chickens were primarily raised for eggs by unpaid family labor (5). Chicken meat was a byproduct. The chickens were often scavengers, consuming feedstuffs on the farmstead that would not otherwise have been utilized. For urban consumers, chicken meat was not plentiful and was expensive relative to pork and beef. These conditions are not much

Table 1--Chicken meat production and trade

	Production			Net exports 1/		
	1961-63	1984-86	Growth rate	1961-63	1984-86	Growth rate
Third World countries	1,444	8,729	8.1	-18	-280	12.7
Industrial market countries	4,659	13,733	4.8	21	355	13.1
United States	2,655	6,885	4.2	87	199	3.7

1/ Exports minus imports. Negative values mean net imports.

Source: (4).



different from those found in many Third World countries today. Few foresaw the technological and organizational innovations that created the broiler industry.

*United States Industrialized  
Broiler Production*

U.S. research made broiler production into an industrial process, greatly lowering the cost of poultry meat to consumers. Balanced, high-energy rations and hybrid birds improved the conversion of grain into meat. Drugs reduced disease losses. Vertical integration from feed preparation to slaughter further reduced costs. The resulting lower prices for consumers helped popularize poultry meat relative to beef and pork.

*Confinement housing*--With the discovery of vitamin D in the 1920's and of its source in the sun's ultraviolet rays, poultry production could be moved indoors simply by supplementing rations with vitamin D.

*Disease control*--Confining thousands of birds together in buildings greatly increased the risk of losses from disease, however. Development of drugs to control these diseases made large-scale confinement economically feasible.

*Improved rations*--Improving rations in the late 1940's and early 1950's greatly reduced feed costs. High-energy rations boosted growth and feed efficiency. Adding antibiotics and vitamins and properly balancing the calories in the ration with amino acids from soybean meal further promoted growth.

Researchers learned that heating soybean meal destroys the trypsin inhibitor in meal which improves the nutritive value of its protein, and that adding synthetic vitamin B-12 permitted its substitution for more expensive protein sources. Before the discovery of vitamin B-12 and how to produce it commercially, poultry producers used animal protein, which contains B-12. Baby chicks must have B-12 for survival and early growth. Hens need it to produce hatchable eggs. With manufactured B-12, the broiler industry could take full advantage of the rapidly growing supplies of soybean meal in the United States (12).

Feeding costs dropped when relatively cheap soybean meal replaced expensive animal proteins and fishmeal as the primary protein source. Protein is needed to supply essential amino acids. Essential amino acids are those the chicken cannot synthesize, and therefore must be supplied directly in the diet. Corn is deficient in the essential amino acids of arginine and lysine (table 2). Fishmeal has a good balance of essential amino acids, but is expensive. Soybean meal is cheaper than fishmeal, but by itself is deficient in methionine and cystine. A balanced, economical ration can be prepared by mixing these and other ingredients.

The impact of the feeding advances was made clear in 1957 feeding trials when chicks were fed recommended rations from 1907, 1932, and 1957 (1). At 9 weeks of age, the average weights of the chickens were 0.6, 2.0, and 3.2 pounds, respectively, for the 1907, 1932, and 1957 rations. The pounds of feed required per pound of gain were 5.2, 3.0, and

Table 2--Percent of chick requirements supplied by feed ingredients  
furnishing 20-percent crude protein to the ration

Feed ingredient 1/	Essential amino acids				
	Arginine	Lysine	Methionine	Cystine	Tryptophane
Corn	83	35	90	97	90
Soybean meal	126	118	70	88	149
Fishmeal	98	168	150	106	130

1/ Each ingredient supplying sole source of protein.

Source (8).

2.0. Though old, these results-- a more than fivefold increase in weight at 9 weeks and a 60-percent savings in feed--show the potential to raise productivity and reduce costs in many Third World countries where poultry rations are as inadequate as were the early U.S. rations.

*Hybrid broilers*--Specialized firms appeared in the 1950's, each with secret lines developed by inbreeding for several generations. These foundation breeders mate selected inbred lines to give high-performing hybrids. The offspring are available throughout the world. Fertile eggs can be stored up to 2 weeks before incubation. They can be shipped anywhere as long as they are kept in the human comfort zone. Day-old chicks can also be shipped easily, but need water and feed within a couple of days.

*Processing equipment*--The mechanization of processing began with on-line dipping of birds in wax to remove feathers in the 1930's. By the 1940's, rubber-fingered machines were being used to remove feathers. Innovations mechanizing other aspects of processing followed, and the industry shifted to the marketing of eviscerated, ready-to-cook broilers.

*Vertical integration*--Broiler production was vertically integrated when feed millers and poultry processors began contracting with independent farmers to raise broilers. Assurance of a market by contractors encouraged many small farmers to go into broiler production. This option was important in some areas of the southern United States where low-income farmers lacked opportunities to improve their incomes (5). Rural communities also benefited from the jobs in feed manufacturing and broiler processing created by the growth of the broiler industry.

Contracting improved the coordination of production and marketing, and speeded adoption of new technology. Vertical integration made it easier to supply the standardized products so important to the modern supermarket and the rapidly developing fast-food industry.

*Advances continue*--Research has continued to improve genetic stock, rations, and labor-saving equipment. These advances

are quickly transferred throughout the world, provided that technical expertise and substantial capital are available.

### *Technology Transfer Requires Foreign Exchange*

Hatching and growing facilities will be needed (table 3). While buildings can be made from local materials, some equipment will likely have to be imported, especially if feeding and watering are to be automated. However, because governments are attentive to the need for jobs, policymakers may question importing equipment for automated feed and water distribution in broiler houses.

Feed mills for preparing rations are a high priority. A local mill can reduce the recurring cost of importing feeds, even if some of the ingredients still have to be imported.

Storage for feed ingredients will be needed to ensure supplies throughout the year. The bins and equipment may need to be imported. Imported equipment will also be needed if slaughtering is to be in modern plants, rather than in traditional markets. In traditional markets, chickens are sold live and often slaughtered on the spot. With urbanization and increasing concern about sanitation, slaughtering in plants becomes more common.

### *Foreign Exchange Also Needed For Feedstuffs and Other Inputs*

Without imports, poultry producers in many Third World countries would have to rely on local, high-cost feedstuffs. Higher-cost feeds mean higher prices for consumers. Consumption would not increase so rapidly, slowing the expansion of the broiler industries.

Supplies of locally grown feedstuffs are limited in most Third World countries. Development and spread of grain varieties that could raise yields and output on a large scale are not imminent. Even as suitable high-yielding varieties are developed, there will still be problems with low soil fertility and, in the semiarid regions, lack of water.

Use of coarse grains to feed poultry and other livestock has outpaced production for two decades, shifting the Third World from a net exporter of grains to a net importer (10).

Table 3--Equipment options for 5 million birds per year  
producing 7,650 metric tons of meat 1/

Equipment costs 2/		Options
Breeders	\$126,000 to 144,000	If watering and feeding are automated, equipment costs will increase 312 percent and labor will be reduced 65 percent.
Growout	\$562,500 to 656,250	If watering and feeding are automated, equipment costs will increase 243 percent and labor will be reduced 20 percent.
Hatcheries	\$420,000 to 458,000	
Feed mill	\$246,000 to 266,000	The expense for storage facilities will depend on how much of annual use will be stored. If 50 percent of annual needs, costs increase 64 percent above mill costs. If 80 percent of annual needs, costs increase 163 percent.
		If grains are to be purchased locally, then drying facilities will likely be needed, raising costs 141 percent above mill costs.
Processing	\$329,000 to 358,000	This covers the equipment for evisceration. If freezing equipment is included, costs increase 151 percent. If rendering of byproducts is also included, costs increase 187 percent.
Total	\$1,683,500 to 1,882,250	If all of the equipment mentioned above is purchased and storage is 80 percent of annual needs, then costs rise 187 percent.

1/ For comparison, the United States slaughters more than 5 billion broilers per year, of which Tyson's, the largest U.S. firm, raises almost 720 million (7). 2/ 1983 f.o.b. New York costs plus ocean freight of 20 percent to Latin America and 30 percent to Asia and Africa.

Source: Adapted from (14).

It is not likely that dependency on grain imports will be reversed.

Soybean meal use is also outpacing production in most Third World countries. The success of Brazil and Argentina in developing large-scale soybean production and processing facilities has not been duplicated elsewhere in the Third World (11). As feeding needs rise, most countries' dependency on soybean meal imports will likely increase.

Broiler industry productivity has been limited by the shortage of foreign exchange in some Third World countries. Zimbabwe, for example, is self-sufficient in grains, but the lack of foreign exchange to import vitamins,

medicines, and minerals means that rations are of lower quality (3).

Broiler industries are also hurt if they cannot import chicks or hatching eggs from foundation breeders in the United States or Western Europe to restock local breeding flocks.

#### *Industrial Production More Common In Higher Income Developing Countries*

In the lower income countries in Asia and Africa the proportion of the total poultry output coming from modern broiler operations is estimated between one-third and two-thirds (6). In the higher income countries of Latin



America, North Africa, and the Far East, the proportion is between 70 and 90 percent. In some Middle Eastern countries, it is above 90 percent.

The more widespread adoption of modern technology in higher income countries follows the general trend for per capita consumption of chicken meat. Chicken meat consumption has grown very rapidly in the higher income Third World countries and is now much higher than in the lower income Third World countries. 1/ The steep rise in consumption has leveled off recently in the higher income countries because of the slowing of economic growth with the world-wide recession of the early 1980's (figure 1).

As consumers in higher income Third World countries eat more chicken, the protein quality of their cereal-based diets improves. Corn protein is deficient in lysine and

tryptophane; wheat is deficient in lysine; and rice is deficient in lysine and threonine. Animal proteins, including chicken, supply these essential amino acids.

Broilers, however, are not always the favored animal protein. Grazing cattle, sheep, and goats will not compete with humans for grains grown domestically or for foreign exchange to import grains, as do poultry.

Some countries, however, do not have sufficient land or a suitable climate either to provide grazing for ruminants or to grow grain to feed poultry or pigs (table 4). When demand for animal proteins grows, countries can import meat, or, in the case of broilers, may import the production technology and the feed ingredients to raise the birds locally.

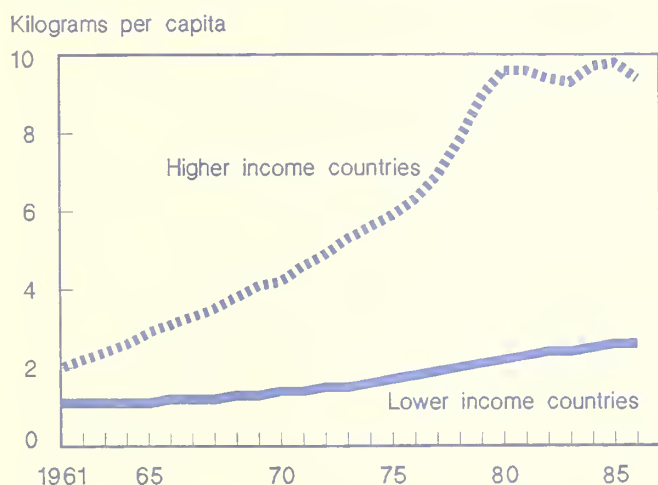
#### *Technology and Grain Imports Reduce Dependency on Chicken Imports*

Twelve countries account for 90 percent of total chicken meat imports by the Third World. These imports created incentives for domestic production. Technology was imported to create modern broiler industries. The resulting increase in domestic production is reversing the long-term trend of increasing dependency on chicken meat imports in many of these countries. Demand for feedstuffs has increased sharply, outstripping local grain production. Grain imports have increased dramatically (see box).

In the Middle East, oil income raised demand for chicken meat. At first, domestic broiler production was slow to expand and these countries became increasingly dependent on chicken meat imports. By the early 1980's, entrepreneurs investing oil earnings in modern broiler facilities had increased domestic production enough to begin moving their countries back toward self-sufficiency. As Middle Eastern countries expanded broiler production, imports of manufactured feed and feed ingredients increased rapidly. Governments sometimes subsidized the cost of these feedstuffs to their broiler producers (2).

In the Far East, the income from the export of manufactured goods raised demand for poultry products. Domestic broiler production expanded using imported technology, but not at the same pace as demand. Because these countries lack

Figure 1  
**Higher Income Consumers Eat More Chicken**



1/ The World Bank classifies developing countries into four categories based on annual per capita income: low-income, lower-middle-income, upper-middle-income, and high-income-oil-exporters. The low-income and lower-middle-income countries, excluding the People's Republic of China, are considered here as lower income Third World countries and the remaining two categories as higher income Third World countries. The lower income countries include 2 billion people with per capita incomes ranging from \$100 to \$1,700. The higher income countries include .5 billion people with per capita incomes greater than \$1,700 (15).

Table 4--Livestock feed in developing countries

	Grain	Protein	Byproducts	Forage and other
Percent of total calories				
Nonruminants				
Poultry	59	13	20	8
Swine	20	3	26	51
Ruminants				
Cattle and buffalo	2	0	2	96
Sheep and goats	0	0	2	98

Source: (13).

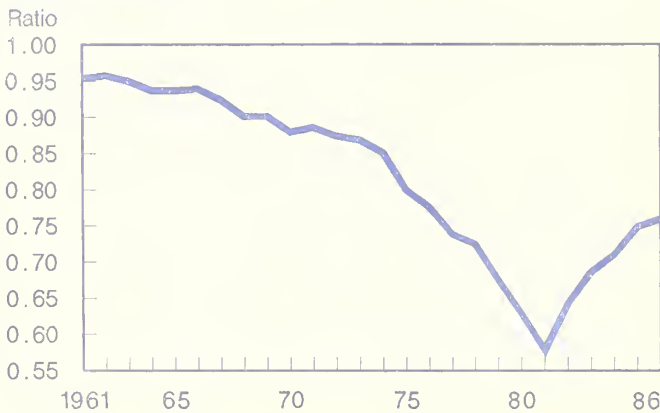
### Major Chicken Importers Move Toward Self-Sufficiency While Grain Imports Increase

Major chicken meat traders in Third World (3-year averages)

	Chicken meat trade		Chicken meat use	
	1979-81	1984-86	1979-81	1984-86
Thousand metric tons				
Major importers:				
Saudi Arabia	172	155	215	401
Iraq	109	79	165	250
Egypt	55	65	140	225
Hong Kong	57	65	94	113
Singapore	19	35	83	95
Kuwait	36	33	48	57
Yemen Arab Republic	45	27	46	29
Oman	11	24	17	72
Jamaica	21	24	51	52
Iran	28	19	208	259
Zaire	4	19	17	33
Mexico	6	14	403	565
Major exporters:				
Brazil	101	284	1,218	1232
Thailand	14	34	302	359

Source: (4).

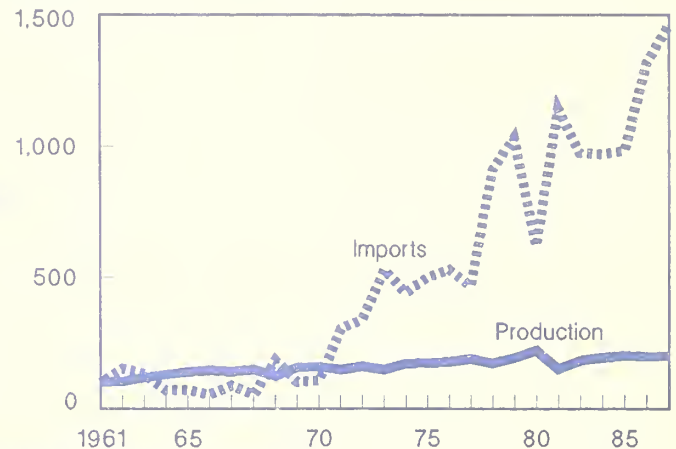
### Chicken Meat Self-Sufficiency: Major Importers



100 equals 100-percent self-sufficiency. Less than 100 means net imports.  
Self-sufficiency ratio is domestic production divided by domestic production plus net imports.

### Corn Production and Imports: Major Chicken Importers

% of 1961



cropland, the feed for their expanding broiler industries is imported. There are limits, however, when land is very scarce, as in Singapore. Environmental concerns of urban populations for problems of wastes, etc. become limitations to expanding production (10).

The transfer of broiler production technology frees these countries of agricultural limits—either poor climate and no water, as in the Middle East, or no cropland, as in the Far East. This technology can also allow countries with abundant agricultural resources to raise broilers for export.

#### *Technology Allows Two Countries To Become Large Exporters*

Brazil and Thailand are significant exporters of chicken meat. Their exports are based on modern production practices and abundant, locally grown feedstuffs. Their exports were more than 95 percent of the Third World total in the mid-1980's. Brazil alone accounted for 85 percent.

Brazil began modernizing its poultry industry with imported technology in 1967, and by 1974 was exporting broiler meat. These exports were promoted by the government with loans at interest rates about two-thirds below commercial rates, and with export aids (6). Exports rose to 20 percent of production by the early 1980's, but have fallen off recently. Brazil is facing increased competition in Middle Eastern markets from Western European and American subsidized exports.

Thailand began modernizing its broiler industry in 1970 (9). Production quickly outpaced consumption and Thailand began exporting in 1973. Ninety percent of these exports are deboned chicken to Japan.

#### *Trade Patterns*

Chicken meat consumption has grown very rapidly in the higher income developing countries, and some of these have become large importers of chicken meat. Other higher income countries, however, have not become large importers, and one, Brazil, is a major exporter. The technology available for broiler production and the suitability of land and

climate for grain production also influence the chicken meat trade.

Trade patterns based on any particular technological gap are usually transitory as innovations spread to other countries. A rapid expansion of broiler production can occur even in countries lacking abundant agricultural resources, because modern poultry production is not linked to the land and climate as is crop agriculture. The transfer of technology can shift such countries from imports of chicken meat to imports of grains and other inputs needed to operate a modern broiler industry.

The growth of Third World markets for chicken meat or technology and grain exports will also depend upon the availability of foreign exchange. Foreign exchange will be available in those countries that are successful exporters of commodities to the highly developed countries, including the United States. In the Middle East it was oil, in the Far East, it was manufactured products.

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